OUR ASTRONOMICAL COLUMN.

THE CAPE OBSERVATORY.—The second portion of the data upon which the forthcoming Cape Catalogue for 1885 will be founded has recently appeared. The first portion, containing the results of the meridian observations made during the years 1879, 1880, and 1881, was published by Dr. Gill some time ago, and the present volume gives the results from the beginning of 1882 to February 8, 1885, when, the programme for the observation of the fundamental stars of Schönfeld's *Durchmusterung*—which stars will form the most important part of the Catalogue—having been completed, further work with the transit instrument was suspended. An additional reason for the interruption of the meridian observations lay in the desirability of re-polishing the object-glass, and of replacing the micrometer screws of the circle microscopes, which were of gun-metal, by steel screws. The investigation of the errors of the screws used in the present observations forms the most important portion of the introduction, for the effect of wear upon them has attracted Dr. Gill's special attention, and has already formed the subject of a lengthy paper by him in the *Monthly Notices* of the R.A.S., vol. xlv. The transit instruments of the Cape and Greenwich Observatories are almost exactly alike in construction; it is therefore interesting to note that there are evident differences in their behaviour; thus the mean horizontal flexure of the Cape instrument, as determined by the collimators, amounts to nearly half a second—0''·462—whilst that of the Greenwich telescope is almost insensible.

The introduction is followed by 144 pages giving the separate determinations of the various instrumental corrections, the readings of the transit-circle thermometers, &c. The ledgers and catalogues for the years 1882, 1883, and 1884 occupy the remaining 400 pages, the catalogues for the three years containing respectively 863, 444, and 1301 stars, reflex or sub-polar observations of stars being counted separately.

THE PARALLAX OF MARS.—We have received a letter from Mr. C. G. Stromeyer, calling attention to the fact that Mars is stationary on March 4, and urging the desirability of determining its parallax by the diurnal method, the rather that it will then be near two sixth-magnitude stars, as will be seen by the following positions:—

	Mag.	R.A.	Decl.
		h. m. s.	° ' ''
95 Virginis	... 6	... 14 0 48	... 8 46 47 S.
94 Virginis	... 6	... 14 0 22	... 8 21 27 S.
Mars ...	..	... 13 56 16	... 9 2 20 S.

Unfortunately, however, the parallax is small—only 11''·3, and only part of this is practically available for the diurnal method, as the planet cannot be observed through a longer period than eight hours at the utmost.

THE LONGITUDE OF ODESSA.—The *Astronomische Nachrichten*, No. 2820, gives the result of the determination, by Dr. E. Becker and Prof. Block, of the difference of longitude between Berlin and Odessa, which was carried out in July and August 1876 by the telegraphic method. The deduced distance in longitude of the centre of the axis of the Repsold meridian-circle of the Odessa Observatory to the east of the centre of the great dome of the Berlin Observatory is given as 1h. 9m. 27·29s.

THE WINKLER OBSERVATORY.—Herr Winkler notifies, in No. 2821 of the *Astronomische Nachrichten*, the transference of his private observatory from Gohlis, near Leipzig (N. lat. 51° 21' 35''·1; long. E. from Greenwich, 0h. 49m. 29·65s.), to the neighbourhood of Jena. The growth of the city of Leipzig rendered the old site no longer a favourable one for observation. The transit-instrument and small 4-inch refractor are already temporarily mounted. The co-ordinates of the new observatory are taken at present as being N. lat. 50° 55' 35''·6; long. E. from Greenwich, 0h. 46m. 20·8s. Herr Winkler publishes at the same time some observations of occultations and eclipses of Jupiter's satellites made in the first half of 1887, which were the last observations made at Gohlis.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 *JANUARY* 29—*FEBRUARY* 4.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on January 29

Sun rises, 7h. 45m.; souths, 12h. 13m. 19·9s.; sets, 16h. 41m.: right asc. on meridian, 20h. 46·1m.; decl. 18° 0' S. Sidereal Time at Sunset, 1h. 14m.

Moon (at Last Quarter on February 4, 19h.) rises, 16h. 20m.*; souths, 0h. 15m.; sets, 8h. 1m.: right asc. on meridian, 8h. 46·0m.; decl. 17° 56' N.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.	
	h. m.	h. m.	h. m.	h. m.	° '
Mercury..	8 16 ...	12 46 ...	17 16 ...	21 18·8 ...	17 39 S.
Venus ...	5 20 ...	9 23 ...	13 26 ...	17 55·5 ...	21 47 S.
Mars ...	23 32*...	5 0 ...	10 28 ...	13 31·9 ...	7 2 S.
Jupiter ...	3 13 ...	7 30 ...	11 47 ...	16 1·6 ...	19 45 S.
Saturn ...	15 51 ...	23 45 ...	7 39*...	8 19·8 ...	20 6 N.
Uranus ...	23 1*...	4 33 ...	10 5 ...	13 4·5 ...	6 9 S.
Neptune..	11 29 ...	19 8 ...	2 47*...	3 41·6 ...	17 54 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich).

Jan.	Star.	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image.
			h. m.	h. m.	° °
29 ...	7 Leonis ...	... 6½ ...	17 41 ...	17 55 ...	332 298
29 ...	ψ Leonis ...	... 6 ...	21 13 ...	21 24 ...	320 300
Feb.					
3 ...	80 Virginis	... 6 ...	3 33 ...	4 44 ...	38 256

Feb. h.
3 ... 8 ... Mars in conjunction with and 2° 50' south of the Moon.

Variable Stars.

Star.	R.A.	Decl.			
	h. m.	° '		h. m.	
U Cephei	0 52·4 ...	81 16 N. ...	Jan. 30,	21 0	*m*
R Canis Majoris...	7 14·5 ...	16 12 S. ...	,, 30,	3 8	*m*
U Monocerotis ...	7 25·5 ...	9 33 S. ...	,, 30,		*M*
U Hydræ	10 32·0 ...	12 48 S. ...	,, 29,		*M*
R Crateris	10 55·1 ...	17 43 S. ...	Feb. 2,		*M*
δ Libræ	14 55·0 ...	8 4 S. ...	Jan. 29,	19 25	*m*
			Feb. 1,	3 16	*m*
U Boötis	14 49·2 ...	18 9 N. ...	Jan. 30,		*m*
U Coronæ	15 13·6 ...	32 3 N. ...	Feb. 1,	4 44	*m*
S Serpentis... ...	15 16·4 ...	14 43 N. ...	Jan. 31,		*M*
U Ophiuchi	17 10·9 ...	1 20 N. ...	,, 29,	23 57	*m*
		and at intervals of		20 8	
X Sagittarii... ...	17 40·5 ..	27 47 S. ...	Feb. 2,	5 0	*m*
U Aquilæ	19 23·3 ...	7 16 S. ...	,, 4,	5 0	*m*
T Vulpeculæ ...	20 46·7 ...	27 50 N. ...	Jan. 29,	19 0	*m*
			Feb. 2,	4 0	*M*
Y Cygni	20 47·6 ...	34 14 N. ...	Jan. 31,	20 22	*m*
			Feb. 1,	20 15	*m*

M signifies maximum; *m* minimum.

GEOGRAPHICAL NOTES.

GENERAL PRJEVALSKY has begun to print his narrative of his fourth journey in Central Asia. It is expected to appear in May, and we may hope that it will find an English translator.

WE are glad to learn that the French explorer of the Gran Chaco, M. Thouars, is safe. The Bolivian Government succeeded in rescuing him from a perilous position among hostile Indians.

A SCOTCH merchant captain, Mr. Strachan, has just returned from New Guinea, many hitherto unexplored parts of which he seems to have visited. It is expected that he will be able to give information that will seriously modify the cartography of the Fly River region. He maintains that the forests in New Guinea are confined to a fringe along the banks of the rivers, and that the bulk of the interior is covered with grass. Captain Strachan has brought home with him a young Papuan boy.

THE steamer *Essex*, of the United States Navy, has been making a series of soundings between Cape Guardafui and Ceylon. In the Indian Ocean, between 60° and 70° E. long., a uniform depth of about 2000 fathoms is almost constantly met with, gradually decreasing as the coast is approached. The greatest depth met with was 2705 fathoms, off the coast of Africa, 160 miles from Cape Guardafui. To the east of this

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maximum, the sea-bed rises suddenly to a depth of only 857 fathoms below the surface.

THE new part of the *Mittheilungen* of the Hamburg Geographical Society contains several papers of interest. Dr. Sievers concludes the long series of papers describing the results of his journeys in Venezuela with some remarks on his original route map of the Venezuelan Cordilleras, which are accompanied by an admirable reproduction of this map. In addition to this, Herr Frohberg arranges and discusses the barometric results obtained by Dr. Sievers. Dr. Zintgraff describes the Lower Congo from Banana to Vivi, and insists on the importance of the Congo for the exploration of the region behind the German Cameroons protectorate. Herr Weisser gives a fairly complete account of German New Guinea and the Bismarck Archipelago; and Herr Hernsheim does the same for the Marshall Islands.

As a supplement to the Indian Survey Report for 1885-86, there has just been issued the narrative of the journey of a native explorer, M—H, through Eastern Nepaul into Southern Tibet, as far as the town of Dingri, and westwards and southwards through Central Nepaul. M—H has succeeded in rectifying in many points existing information on the hydrography of the region traversed, and gives many useful notes on its physical geography and its flora, as well as on the people.

OUR ELECTRICAL COLUMN.

THE additional facts added to our knowledge of electricity in 1887 are not very numerous, but the impetus given to its practical applications was very encouraging. One of the most important scientific discoveries was that of Prof. J. J. Thomson, which formed the subject of the Bakerian Lecture, viz. that sparks in tubes dissociated iodine, bromine, and chlorine. In iodine the dissociation produced at 214° C. was as much as that effected directly by Victor Meyer at 1570° C.

PROF. EWING showed that there was apparently no limit to the magnetization of iron in strong magnetic fields when we increased the magnetizing force, and Prof. Roberts Austen showed that it was impossible to separate the elements of alloys by means of electric currents.

IMMENSE improvements have been made in the construction of dynamos, motors, accumulators, and secondary generators, and in consequence electric lighting and working of railways and tramways are upon a commercial and useful stage. Many other causes besides restrictive legislation have retarded electric lighting in England, but there are now many signs that this useful industry is in more senses than one about to commence a very bright career.

SEVERAL useful constants have been added to our notebooks during the past year. Dr. John Hopkinson is pursuing his examination of the specific inductive capacity of oils and other liquids.

MR. PREECE has determined the coefficient of self-induction of straight iron telegraph aërial wires to $0{\cdot}005 \times 10^9$ centimetres per mile, while that of copper wire is practically *nil.* He has also measured the current which will just actuate a Bell telephone, and he found it to be 6×10^{-13} ampere.

THE application of powerful electric currents to smelting, as in the Cowles process for producing aluminium, and to welding, as proposed by Elihu Thompson, is gaining rapid progress, while the use of enormous dynamos for the deposition of pure copper from impure ores is gaining ground with giant strides. Messrs. Bolton, at Widnes, and Messrs. Vivian, as well as Messrs. Lambert at Swansea, are each depositing from forty to fifty tons of copper per week by currents of from 5000 to 10,000 amperes.

THE Society of Telegraph-Engineers and Electricians has decided to change its title to that of the Institution of Electrical Engineers—a change for the better. Mr. Graves, the new President, gave an exceedingly interesting address on the industrial importance of electricity, and he brought out the remarkable fact that there are at least 300,000 persons in the United Kingdom depending upon electrical industry for their daily bread.

SOME of our prominent workers in the field of electricity, such as Lord Rayleigh, Sir William Thomson, and Prof. Hughes, are conspicuous by their absence during the past year, although the two former have been by no means idle in other directions.

A NOTE ON VALENCY, ESPECIALLY AS DEFINED BY HELMHOLTZ.[1]

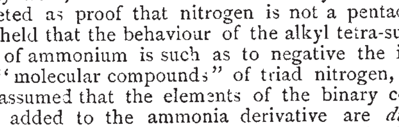
VERY little has been either said or written of late on the subject of valency—not because the topic is admitted to be exhausted, nor because our views can be regarded as reposing on a fixed basis of fact, but more I believe on account of the feeling being almost universally entertained that little is to be gained by continuing the discussion from our present standpoint.

My purpose in this note is to call attention to the extreme importance of reopening the discussion on account of the intimate bearing that it has on the work in which the Electrolysis Committee, jointly appointed by Sections A and B, are now engaged; and to urge that it is time that the gage thrown down by Helmholtz in the Faraday Lecture (Chem. Soc. Trans., 1881, p. 277) was uplifted by chemists.

We are told by Helmholtz that it is a necessary deduction from the fundamental law of electrolysis established by Faraday, that definite, as it were atomic, charges of electricity are associated with the atoms of matter; that, in fact, a monad bears a single charge, a dyad two, a triad three; and that when combination occurs the charges are still retained by the atoms but neutralize each other—"the atoms cling to their charges, and opposite electric charges cling to each other." I cannot help thinking, however, that Helmholtz deprives his statement of much of its force and simplicity by adding: "But I do not suppose that other molecular forces are excluded, working directly from atom to atom." He is led to do this apparently by being aware of the distinction which it is usual to draw between atomic and molecular compounds. The attempt should at all events be made—and in my paper on "Residual Affinity" I have already ventured the first step—to include both classes of compounds, molecular as well as atomic, in the discussion; indeed it is somewhat difficult to reconcile the passage above quoted with the following statement which occurs previously in the lecture: "The law of the conservation of energy requires that the electromotive force of every cell must correspond exactly with the total amount of chemical forces brought into play, not only the mutual affinities of the ions, *but also those minor molecular attractions produced by the water and other constituents of the fluid.*" The italics are mine. But if the "minor molecular attractions" contribute to the electromotive force of the cell, then conversely these also will have to be overcome in effecting electrolysis, and are as much to be reckoned as are the "mutual affinities of the ions"!

It is obvious that if it should prove possible to decide what number of charges are necessarily associated with any particular atom, the conception of valency will have acquired a definiteness which cannot possibly be attached to it as long as the views that have hitherto guided us are adhered to. A decision must involve the discussion of the question of the existence of molecular as distinct from atomic compounds.

To cast the apple of discord without further preface, I would direct attention to the insufficiency of the evidence on which it is usual to rely as proof that nitrogen, for example, is a pentad; nay more, I would assert that this very evidence should be interpreted as proof that nitrogen is not a pentad. It is commonly held that the behaviour of the alkyl tetra-substituted derivatives of ammonium is such as to negative the idea that these are "molecular compounds" of triad nitrogen, and that it must be assumed that the elements of the binary compound which are added to the ammonia derivative are *distributed* in the ammonium derivative; for example, that in the formation of tetramethylammonium iodide from trimethylamine and methyl iodide the methyl and iodine of the iodide part company and separately attach themselves to the nitrogen, thus:—



$$\mathrm{N}(\mathrm{CH_3})_3 + \begin{matrix}\mathrm{CH_3}\\ | \\ \mathrm{I}\end{matrix} = \begin{matrix}\mathrm{CH_3}\\ \mathrm{I}\end{matrix}\!>\!\mathrm{N}(\mathrm{CH_3})_3$$

But I contend that the properties of tetramethylammonium iodide and hydroxide prove that such is not the case: the iodide, it is well known, can be boiled for hours with the strongest caustic potash solution without undergoing change; there is not a single

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[1] A Paper read by Prof. Henry E. Armstrong, F.R.S., in Section B of the British Association at Manchester. Communicated by the Author.

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